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IS 5500-1 (2004): Vibration roller - General requirements,
Part 1: Self propelled tandem drum [MED 18: Construction
Plant and Machinery]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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IS 5500 (Part 1) : 2004

भारतीय मानक

कंपन रोलर — सामान्य अपेक्षाएँ

भाग 1 स्वतः नोदनित अग्रपश्च ड्रम

(दूसरा पुनरीक्षण)

Indian Standard

VIBRATORY ROLLER — GENERAL REQUIREMENTS

PART 1 SELF-PROPELLED TANDEM DRUM

(*Second Revision*)

ICS 93 080 10

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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FOREWORD

This Indian Standard (Part 1) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Construction Plant and Machinery Sectional Committee had been approved by the Mechanical Engineering Division Council.

The tandem vibratory rollers are versatile compacting machines and can be used for all types of soils and road construction materials and under various conditions. The success of vibratory rollers lie in their ability to compact a wide range of soils and road construction materials in deeper lifts and in less time than the conventional compacting equipment. The vibration induced to the compacted layer reduces the friction between the particles of the material which are reoriented and brought closer together as air voids are eliminated, thus binding the material into denser state. Further compaction results from the static load and the centrifugal force applied by the vibrating roll on the material to be compacted. The total compacting force of a vibratory roller is, thus, significantly more than the mass of the machine.

This standard was first published in 1969 covering the general requirements for both self-propelled single drum and double drum (tandem) vibratory rollers. The first revision was taken up in 1977 to incorporate modification in the provisions relating to speed, fuel system, manufacture, etc. As a result of increasing use of different types of vibratory rollers in earthwork and road construction in our country, suggestions were received for preparing separate standards for vibratory rollers of single drum and tandem drum. Accordingly, it was decided to split this standard in two parts. First part was to cover tandem drum vibratory rollers and the second part was to cover single drum vibratory rollers. The second part was published in 1992 as a separate standard for self-propelled heavy duty single drum vibratory roller. However, the preparation of separate standard for tandem drum vibratory roller as IS 5500 (Part 1) could not be taken up, at that time. In view of various technical modifications in the last few years, it was decided by the Committee to prepare a separate standard for self-propelled tandem drum vibratory roller as IS 5500 (Part 1) and also to revise IS 5500 (Part 2) : 1992 'Vibratory roller — General requirements : Part 2 Self-propelled heavy duty single drum (*second revision*)'.

In the preparation of this standard due consideration has been given to the provisions of *Central Motor Vehicles Rules*. However, this standard is subject to restrictions imposed under this Act, wherever applicable.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

VIBRATORY ROLLER — GENERAL REQUIREMENTS

PART 1 SELF-PROPELLED TANDEM DRUM

(*Second Revision*)

1 SCOPE

This standard (Part 1) lays down the requirements for material, size, design, construction and performance of self-propelled tandem drum vibratory roller.

2 REFERENCES

The standards listed in Annex A contain provisions, which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated at Annex A.

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Self-Propelled Tandem Vibratory Roller — A machine with two rollers/drums and powered by internal combustion engine mounted on the roller. The engine provides power for both movement and vibrations with mechanism to permit either drive/vibrations to be operated independently. It should be capable of forward and backward movement

3.2 Amplitude (Nominal) — It is expressed as half of actual vertical displacement when the drum is freely suspended and operating at rated frequency. It can be calculated by using the following formula:

$$A = (1\,000 \cdot m \cdot r) / M$$

where

- A = nominal amplitude, in mm;
- m = eccentric mass, in kg;
- r = radius of eccentricity, in m;
- $m \cdot r$ = eccentric moment; and
- M = vibrating mass, in kg.

3.3 Centrifugal Force — Force generated by vibrating mechanism at rated frequency. This is the product of the eccentric moment and the square of the

angular velocity. To calculate the centrifugal force, following formula can be used:

$$F_C = 4 \pi^2 (m \cdot r) f^2$$

where

- F_C = centrifugal force, in Newton (N),
- $m \cdot r$ = eccentric moment, in kg-m, and
- f = frequency of vibration, in cycles per second (Hz).

3.4 Drum — A rotating cylindrical member used to transmit compaction force to the surface.

3.5 Eccentric Moment ($m \cdot r$) — The product of eccentric mass (m) and its radius of eccentricity (r).

3.6 Frequency (f) — The numbers of complete vibration cycles of the vibrating drum per second.

3.7 Gradability — The slope/ground angle at which the roller is able to start and travel at a constant speed under its own power on firm, hard and even sub-soil in forward and reverse direction with/without vibrations at rated frequency.

3.8 Ground Clearance — The vertical distance between a firm horizontal surface and the lowest point on the roller and not belonging to drum.

3.9 Static Linear Load — The static weight at the drum module divided by the width of the drum and is expressed as N/mm.

3.10 Non-vibrating Mass — The masses of all the parts that are supported on vibrating drum and not subjected to vibrations.

3.11 Operating Weight — The gross weight of the basic machine with all its standard accessories, operator weighing 75 kg, half full fuel tank, full hydraulic tank, lubricating, cooling system and, when applicable, with sprinkling water tank half full.

3.12 Pass — A one-way trip or passage of the roller. A round trip on the same path is considered two passes.

3.13 Shipping Weight — The weight of the roller as shipped by the manufacturer. This should correspond to the weight of the machine without operator, with

hydraulic/lubricating and cooling system filled, fuel tank filled to its 10 percent capacity, sprinkling water tank (when applicable) empty, without ballast and with or without cab, canopy as stated

3.14 Weight on Drum or Drum Module Weight —

The portion of the operating weight exerted on the ground through the drum

3.15 Turning Radius (Inner) — The radius of the circle described by the inner edge of the rear drum when the machine is executing its sharpest practicable turn without vibrations (see Fig 1)

3.16 Turning Radius (Outer) — The radius of the circle described by the outer edge of the front drum when the machine is executing its sharpest practicable turn without vibrations (see Fig 1)

3.17 Turning Circle — The diameter of the circle, which will enclose the outermost projection of the roller with all its basic equipment while executing its sharpest practicable turn (see Fig 1)

3.18 Vibrating Mass (M) — The mass of the vibrating drum along with the mass of all other parts which are directly mounted on the drum including up to vibration isolators

3.19 Volume Capacity — It is calculated from the following formula

$$Q = C W V H X 1000/n \quad \text{m}^3/\text{h}$$

where

- C = assumed efficiency factor,
- = practical capacity/Theoretical capacity,
- W = drum width, in m,
- V = roller speed, in km/h,
- H = layer thickness after compaction, in mm,
- n = number of passes, and
- X = number of vibrating drums

4 COMPONENT NOMENCLATURE

The nomenclature of the major components of the roller is shown at Fig 2

5 DIMENSIONS

The main dimensions of the roller are illustrated at Fig 3

6 DESIGNATION OF SIZES

6.1 The sizes of the vibratory rollers shall be specified in terms of the operating weight of the equipment without ballast (see 3.11)

6.2 The self-propelled tandem rollers shall be of the following sizes based on its operating weight

- a) Up to 2 t,
- b) Above 2 t up to 4 t,
- c) Above 4 t up to 6 t,

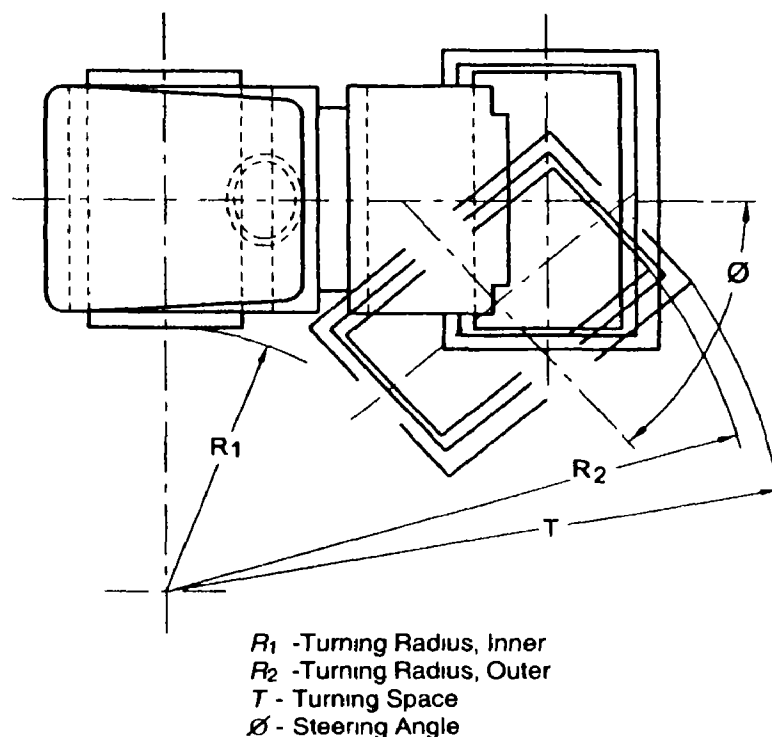


FIG 1 TURNING RADII OF SELF PROPELLED TANDEM DRUM VIBRATORY ROLLER

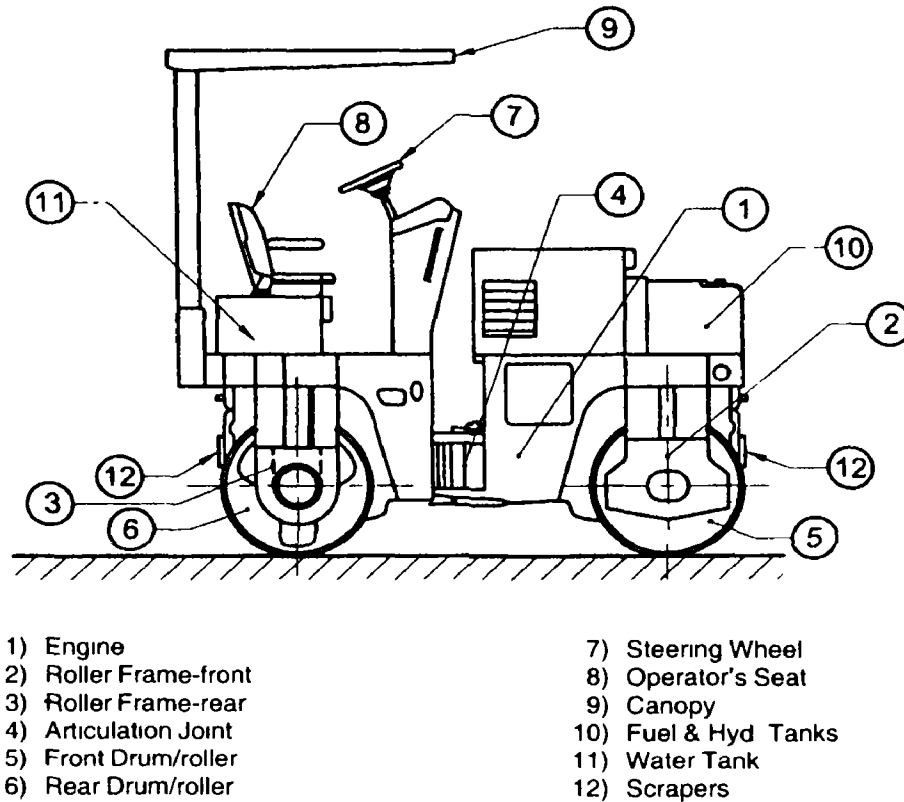


FIG 2 COMPONENT NOMENCLATURE OF SELF-PROPELLED TANDEM DRUM VIBRATORY ROLLER

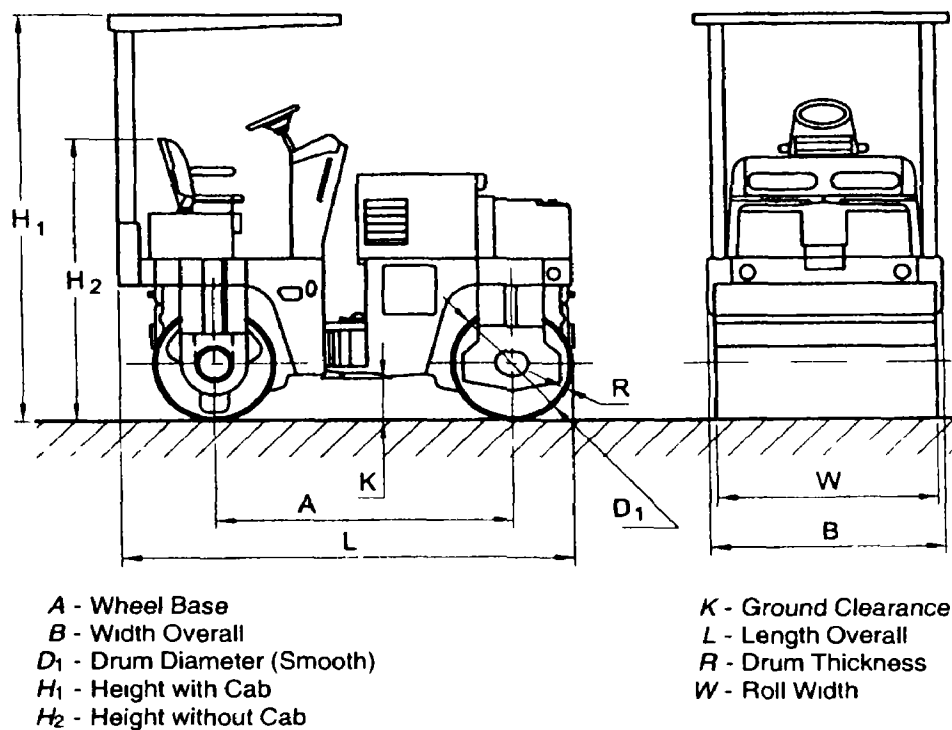


FIG. 3 MAIN DIMENSIONS OF SELF-PROPELLED TANDEM DRUM VIBRATORY ROLLER

IS 5500 (Part 1) : 2004

- d) Above 6 t up to 8 t,
- e) Above 8 t up to 10 t, and
- f) Above 10 t

The operating weight (*see* 3.11) shall be within ± 10 percent of the specified value

7 MATERIALS

7.1 The material used for construction of the vibratory roller shall comply with the requirements given at 7.1.1 to 7.1.10

7.1.1 Steel Plates, Bars and Sections

These shall conform to IS 2062 or IS 8500

7.1.2 Steel Sheets

These shall conform to IS 513 or IS 1079

7.1.3 Steel Castings

These shall be of suitable grade conforming to IS 1030 or IS 2644 or IS 2708

7.1.4 Grey Iron Castings

These shall be of suitable grade conforming to IS 210 or IS 6331

7.1.5 Spheroidal Grey Iron Casting

These shall be of suitable grade conforming to IS 1865

7.1.6 Carbon and Alloy Steel Components

These shall be manufactured from suitable grade of steels conforming to IS 1875 or IS 3930 or IS 4432. In case of carbon steel forgings, these shall be of suitable class conforming to IS 2004

7.1.7 Springs

These shall be manufactured from suitable grade of wire conforming to IS 4454 (Part 1) or IS 4454 (Part 2)

7.1.8 Rivet Bars

These shall conform to IS 1148.

7.1.9 Steel Tubes

These shall conform to IS 1239 (Part 1).

7.1.10 V Belts

V-belts for belt drives shall conform to IS 2494 (Part 1)

7.2 Any other material used for components of roller shall conform to its relevant Indian Standard, if available or as agreed to between the purchaser and the supplier

7.3 The standard brought-out parts used on the roller shall conform to relevant Indian Standards.

8 CONSTRUCTION

8.1 The construction of the vibratory roller shall be robust and capable of withstanding continuous strain likely to be imposed during the operation

8.1.1 The design and construction of the vibratory roller shall be such as to isolate all parts from vibrating drum by provision of effective anti-vibration mounts and other suitable means

8.1.2 All parts of the machine requiring frequent replacement, regular attention and periodic maintenance shall be easily accessible with minimum dismantling of any fittings or parts

8.1.3 The parts of the machine which are exposed to atmosphere and are liable to become defective due to continuous exposure to dust and weather shall be covered/protected adequately by proper coatings

8.2 Main Frame

The frame shall be made of structural steel with rolled or formed steel channel section (or other suitable sections) or steel plates. It should be suitably reinforced to form a rigid structure to ensure that no deformation occurs during the use throughout the life of the vibrating roller. The frame shall be mounted on the vibratory roller through anti-vibration mounts to ensure that vibrations are isolated from the frame

8.3 Vibratory roll shall be fabricated from suitable thickness of steel plates (*see* 7.1.1) using appropriate welding process. The non-vibrating roll may be made of either steel plates as mentioned above or cast iron conforming to grade FG 300 of IS 210 and having hardness of 180 to 240 BHN. The hubs shall be fitted with renewable bushes or suitable heavy-duty bearings. The non-vibrating roll may have provision for ballasting by sand or water. Vibrating roll shall not be ballasted

8.4 Transmission

A suitable transmission of hydrostatic type may be employed to impart forward/reverse motion to the vibratory roller. The transmission housings shall be of cast iron conforming to grade FG 200 of IS 210 or fabricated from steel plates (*see* 7.1.1). The gears and shafts shall be of machine cut-teeth. All gears, shaft, splines shall be of steel conforming to IS 1875 or IS 2004 or IS 3930 or IS 4432 or equivalent. All gears and shafts shall be so designed as to withstand shock loads during use. Adequate provision shall be made for lubrication of all bearings, shafts and gears

9 VIBRATING MECHANISM

9.1 The vibrating mechanism employed on the roller shall consist of eccentric weight/shaft rotating inside and on the roller axis. This mechanism shall be either driven by hydraulic motor or through mechanical

arrangement from power unit mounted on the frame. The vibrating mechanism shall work independent of roller drive and shall have controls for actuation.

9.2 The frequency and amplitude of vibration of the roller for different applications shall be as given below:

<i>Application</i>	<i>Frequency, Hz (vibrations/min)</i>	<i>Amplitude mm</i>
Embankments and sub-grade soils	25-30 (1 500-1 800)	1.5-2.0
Granular and stabilized bases and sub bases	25-50 (1 500-3 000)	0.8-2.0
Asphalt surfacing	33-50 (2 000-3 000)	0.3-0.8

9.3 The vibrating mechanism shall be such that it is able to operate at desired frequency/frequencies and their corresponding amplitude/amplitudes (as agreed to between the purchaser and the supplier), independent of propulsion system, while the roller is operating for compaction on operating surface.

9.4 If more than one frequency of operation is provided on the roller, suitable controls for selection of proper frequency shall be provided at the operator's station.

10 ENGINE

10.1 The prime mover shall be diesel engine conforming to IS 10001 or IS 10002. The engine shall have adequate power so that it shall be capable of operating the roller in the conditions given at **10.1.1** and **10.1.2**. Intermittent rating of the engine can be considered based on the actual equipment requirement.

10.1.1 The roller shall be capable of operating satisfactorily without damage to any component while working under following atmospheric conditions:

- Ambient temperature between -5°C and 50°C for altitudes up to 1 000 m, and
- 20 to 100 percent relative humidity at any temperature up to 29°C .

10.1.2 The roller shall be capable of performing to its specifications up to 1 000 m altitudes, above mean sea level. For altitude above 1 000 m and extreme temperature conditions, engine with adequate power shall be used based on the following operating conditions to be specified by the purchaser:

- Maximum altitude at site,
- Minimum and maximum ambient temperature at site, and
- Minimum and maximum relative humidity at site.

10.2 The engine shall be provided with 12 V/24 V electric starting system.

10.3 The engine shall be provided with a suitable size of alternator so as to keep the battery charged even when the roller is used at night with entire illumination system.

11 FUEL SYSTEM

The fuel tank shall be of adequate capacity in order to enable a minimum of 10 h of roller operation at its rated performance. The fuel-filling orifice shall incorporate a removable filter and shall be so designed and so placed that filling by jerry-cans, without the aid of funnel, presents no difficulty. The method used for venting the fuel tank to the atmosphere shall be such that no fuel spillage occurs when the roller is travelling with the tank completely filled. The draw-off from the fuel tank to the engine shall leave 5 percent dead volume below it at any operating angle up to 12° . A plug shall be provided to drain the tank completely. A suitably calibrated fuel gauge or dipstick shall be provided. Fuel filters of adequate capacity for the conditions specified at **10** shall be incorporated in the system.

12 RADIATOR

A radiator of adequate capacity shall be provided for water-cooled engines as recommended by prime mover manufacturers to keep the temperature of the coolant always within the optimum operating temperature of the engine and within the permissible limits. The radiator shall be resiliently mounted to withstand shocks transmitted through the frame. A drain tap shall be provided in the radiator.

13 SPEEDS

The roller shall be so equipped so that the machine speed can be varied from the minimum speed to the maximum speed depending on compaction requirements or for movement of machine between sites. The roller shall have provision for indicating operating speed by suitable marking.

14 STEERING

The roller shall be provided with adequate mechanism to enable steering from operator's station.

15 BRAKES

Mechanical or hydrostatic brakes shall be provided on the drive roll which can be either foot or hand operated. In addition to above a suitable parking brake arrangement shall be provided, which can hold the roller stationary over a slope of 1.5 : 10.

16 GRADIENT

The engine power as well as braking system shall be so designed that the roller can be safely operated up to a gradient of 3 in 10, with or without vibrations.

17 WATER SPRINKLING

In the case of tandem roller for asphalt compaction water sprinkling system shall be provided for drums, with adequate controls. The water tanks shall be such that the inside surface will have treatment for resistance to corrosion. The capacity of the tank shall be sufficient for one-hour continuous operation.

18 SCRAPERS

Scrapers, for cleaning the outer surface of the roll, to act in either direction shall be installed on each roll. The scraper shall cover the full width of the roll and shall be adjustable.

19 AWNING

If so desired by the purchaser, suitable robust awning with heat insulating lining shall be provided to protect the operator from being exposed to direct sunlight and rain.

20 CONTROLS

20.1 Following controls shall be provided and be easily accessible to the operator

- a) Starting and stopping switch/button/lever for the engine,
- b) Gear shift lever/speed selection switch,
- c) Forward and reverse direction actuation lever,
- d) Brake pedal, if hydrostatic brakes are not employed,
- e) Parking brake lever, if hydrostatic brakes are not employed,
- f) Vibration actuation switch/lever; and
- g) Heater push button (for cold starting) (optional)

20.2 Dipstick or any other suitable arrangement shall be provided to check the oil level in the engine sump/gear box, if provided, and hydraulic tank.

20.3 Following instruments and gauges shall be provided on the dashboard of the machine

- a) Engine oil pressure gauge,
- b) Engine water temperature gauge, if water cooled engine is used;
- c) Fuel gauge shall be provided near the operator in the case of rollers weighing more than 1 t static weight. Alternatively a graduated dipstick shall be provided at the fuel tank for fuel level indication,
- d) Battery charging warning lamp/ammeter/voltmeter,
- e) Speedometer (optional);
- f) Hour meter;
- g) Push button switch for horn;
- h) Engine rpm meter (optional);

- j) Lubricating oil temperature gauge, if air cooled engine is used, and
- k) Belt failure indicating lamp or audible warning device, if air cooled engine is used

21 LIFTING AND TOWING ARRANGEMENTS

21.1 The roller shall be provided with suitable means of lifting by slings and crane

21.2 The roller shall be provided at the front and rear with suitable arrangement for towing

22 LUBRICATION

All moving parts shall be adequately lubricated by appropriate arrangements keeping maintenance schedule as simple as possible

23 SAFETY REQUIREMENTS

23.1 Safety guards for all moving parts, wherever possible, shall be provided

23.2 Reflectors at the front, rear and both sides, at the outermost edges, shall be provided to show the presence of the roller at night to the vehicles using the road

23.3 The minimum ground clearance shall be

- a) 150 mm, minimum for rollers up to 4 t
- b) 300 mm, minimum for rollers above 4 t

23.4 Lights at the front and rear of the roller shall be provided for its safe operation at night. The safety glass, windscreen wiper, signalling devices, direction indicators and stoplights, if used, shall conform to the relevant Indian Standard, if available, or as agreed to between the purchaser and the supplier

23.5 Electrically operated horn shall be provided in the machine.

23.6 As specified in IS 12239 (Part 1), the outlet of the exhaust pipe shall be located in such a way that the driver or any other operator obliged to stand on the machine shall not normally be exposed to harmful concentration of noxious gases or fumes

24 FINISHING

24.1 All exposed parts of the roller shall be cleaned, treated and coated with suitable anti-corrosive protective coating conforming to the relevant Indian Standard.

24.2 The electrical connections including the wires, terminals, components and circuit elements shall be suitably treated to resist the growth of corrosion and fungi. The electrical wires shall be enclosed in suitable covers to protect it from damage due to rubbing and such covers shall be adequately sealed against water ingress. Rubber grommets shall be provided at the

metallic parts from where the electrical wires are passing through

25 TOOLS AND INSTRUCTION MANUALS

25.1 Tool Box

A lockable tool box containing the necessary tools for normal adjustment, lubrication and routine maintenance along with list of tools shall be provided

25.2 Operator's Manual

The operator's manual containing the instructions and precautions for proper use of the roller shall be provided. It shall also contain instructions for routine maintenance/service and preventive maintenance

25.3 Parts Manual

A parts manual containing details of serviceable and non-serviceable parts along with their part numbers shall be supplied with the roller

26 MARKING

26.1 Rating Plate

Each machine shall have a rating plate firmly attached to main frame where it can be easily read and shall not be easily removed. The plate shall have clearly marked on it the following information

- a) Manufacturer's name and address,
- b) Model,
- c) Machine serial number,
- d) Year and month of manufacture,
- e) Operating weight, and

- f) Engine's make, serial number, horse power and rev/min

26.2 The required inflation pressure of the tyres shall be marked on appropriate place near the tyres

26.3 Instruction and Warning Plates

The machine shall have permanently affixed to it, and suitably located instruction and warning plates/stickers indicating precautions and any special or important procedures to be observed in operation and servicing the equipment

27 INFORMATION TO BE SUPPLIED BY THE MANUFACTURER/SUPPLIER

The manufacturer/supplier shall provide the following information

- a) Weight without ballast,
- b) Weight with water ballast, if applicable,
- c) Weight with sand ballast, if applicable,
- d) Forward and reverse speed,
- e) Specifications of engine,
- f) Line pressure at front and rear rolls,
- g) Rolling width,
- h) Diameter of front and rear rolls
- j) Width of front and rear rolls
- k) Wheel base,
- m) Turning radius,
- n) Overall length,
- p) Overall width,
- q) Overall height with/without awning, and
- r) Water tank capacity

ANNEX A

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

<i>IS No</i>	<i>Title</i>	<i>IS No</i>	<i>Title</i>
210 1993	Grey iron castings — Specification (<i>fourth revision</i>)	2708 1993	1.5 percent manganese steel castings for general engineering purposes (<i>third revision</i>)
513 1994	Cold-rolled low carbon steel sheets and strips (<i>fourth revision</i>)	3930 1994	Flame and induction hardening steels (<i>second revision</i>)
1030 1998	Carbon steel castings for general engineering purposes (<i>fifth revision</i>)	4432 1988	Case hardening steels (<i>first revision</i>)
1079 1994	Hot rolled carbon steel sheets and strips (<i>fifth revision</i>)	4454 (Part 1) · 2001	Specification for steel wires for mechanical springs Part 1 Patented and cold drawn steel wire — Unalloyed (<i>third revision</i>)
1148 1982	Hot-rolled rivet bars (up to 40 mm dia) for structural purposes (<i>third revision</i>)	4454 (Part 2) 2001	Specification for steel wires for mechanical springs Part 2 Oil hardened and tempered spring steel wire and valve spring wire (<i>second revision</i>)
1239 (Part 1) 1990	Mild steel tubes, tubulars and other wrought steel fittings — Specification Part 1 Mild steel tubes (<i>fifth revision</i>)	6331 1987	Automotive grey iron castings (<i>first revision</i>)
1865 1991	Iron castings with spheroidal or modular graphite (<i>third revision</i>)	8500 1991	Structural steel — Micro-alloyed (medium and high strength qualities) — Specification (<i>first revision</i>)
1875 1992	Carbon steel billets, blooms, slabs and bars for forgings (<i>fifth revision</i>)	10001 1981	Performance requirements for constant speed compression ignition (diesel) engines for general purposes (up to 20 kW)
2004 1991	Carbon steel forgings for general engineering purposes (<i>third revision</i>)	10002 1981	Performance requirements for constant speed compression ignition (diesel) engines for general purposes (above 20 kW)
2062 1999	Steel for general structural purposes — Specification (<i>fifth revision</i>)	12239 (Part 1) 1996	Guide for safety and comfort of operator of agricultural tractors and power tillers Part 1 General requirements (<i>first revision</i>)
2494 (Part 1) 1994	V-belts — Endless V-belts for industrial purposes Part 1 General purpose — Specification (<i>second revision</i>)		
2644 · 1994	High tensile steel castings (<i>fourth revision</i>)		

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically, a standard along with amendments is reaffirmed when such review indicates that no changes are needed, if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards Monthly Additions'.

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Amendments Issued Since Publication

Amend No	Date of Issue	Text Affected

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